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Big data analytics for mask prominence in COVID pandemic

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ABSTRACT

Corona Virus is spreading at an alarming rate in community causing respiratory diseases like SARS and MERS, which has laid down Government agencies and healthcare organizations to adopt and recommend various strategies in order to cease the spread of corona virus. Till the dawn of Vaccine, only available cost-effective preventive aid is the use of face mask. Since the outbreak of covid-19, demand for the face mask has been increased tremendously which has led to the shortage of face mask. Various masks are available in the market, but reuse and decontamination of reusable face mask has become the topic of concern. Commonly available masks in market are N-95, Medical/Surgical Mask and cloth masks. N-95 and Respirators should be reserved for frontline primary Healthcare professionals which are involved in High-risk aerosol generating procedures, while Surgical and medical mask should be used by secondary healthcare professionals and cloth masks by General public.

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1. Introduction

Since December 2019, the only topic in boom is the pandemic situation created by the novel coronavirus (covid-19), which has laid down its serious ill effects not only on healthcare but also on economic sector all around the globe. Since the outbreak of Covid-19, many new terminologies came into play like social distancing, nationwide lockdowns, use of mask at public places, sanitizers, etc. When it comes to COVID-19, it is basically caused by Severe Acute Respiratory Syndrome Corona virus-2(SARS-Cov-2) [1]. Corona Virus (COV) is a positive stranded RNA virus, that appears crown like when observed under microscope as they have spike like glycoproteins on their envelope, known to be originated from Bat, which is still unclear and part of a debate. COV can lead to various clinical manifestations right from fever, cough, and shortness of breath, diarrhoea, vomiting and common cold to fatal diseases like MERS (Middle East Respiratory Syndrome) and SARS [1–3]. Basically Respiratory droplets are considered as the main mode of transmission for COVID-19; however, mode of transmission is yet to be evidently confirmed [4]. As of now 68,165,877 confirmed cases, including 1,557,385 deaths have been reported by

WHO on 10th December 2020 [5]. As the Corona Virus is spreading at an alarming rate, it has become mandatory for various healthcare authorities and organizations to curb the spread of COVID-19 virus, triggering many research scientist, technologist and healthcare professionals to work at forefront for the development of vaccine and effective treatment to safely treat the community against Corona virus [6,8]. Till the development of vaccine it has become mandatory to cease the spread of corona virus, which has enforced various health authorities and Organization to adopt various policies and strategies and recommend it as soon as possible to community as well as healthcare professionals as a preventive aid in combating Corona Virus such as social distancing, compulsory use of mask at public places and use of Personal Protective Equipment's (PPE Kits) by Primary Health care professionals who are involved in high risk procedures [5,7]. The Primary diagnosis carried out to detect the disease is RT-PCR, which can detect all four respiratory HCOVs in real time. None of the antiviral drugs available directly target HCOVs, hence these treatment options are supportive in nature. For e.g. Interferon's, Hydroxy-chloroquine, Azithromycin Vitamin -C, etc.

[8] As per general say, precaution is better than cure, various preventive measures are being developed to avoid infection of Corona virus. With other few preventive procedures, wearing face mask has gained enormous importance since it is most significant

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way of evading infection of Corona virus. In this article, author aim at highlighting various types of mask in use, proper handling and disposal to cease the spread of Corona virus.

2. Objective

The motive of this article is to explore mask and its role in combating Covid-19 Pandemic situation by presenting a thorough literature survey and real time dataset in order to benefit public health and community.

3. Literature survey

Online report on topic [9], stated recommendations with regards to use of cloth masks, inferiority of cloth mask over medical mask and respirators.

A Research study on topic [10], reported information on commercially fabricated and sewn fabric mask by assessing them in terms of their particle filtration efficiency concluding that 3 M band mask had mean removal efficiency of 75% while Sewn mask has 60%.

Review on topic [11], stated various types of mask and concluded that Respirators should be preserved for Primary healthcare Professional engaged in high risk procedures, Surgical mask for Low risk procedures and cloth mask for Public. A Research Study on [12], statistically analysed the per capita mortality by Corona virus and adoption of mask in various countries and its impact on prevention of disease along with graphical representation of mask effect.

An article on topic [13], concluded logically that utilization of reusable Elastomeric Respirators with Filtering Efficiency of 95% and above having ability to replace 100 s of N95 mask, along with its proper disinfection. Evidence Review on [14], evidently suggested filtering capabilities and mask efficiency study and impact on community transmission by mask, by presenting literature survey conducted by RCT

Research study on [4], reviewed that medical mask and N95 mask offer similar protection against COVID in Healthcare Professionals during non-aerosol generating care, hence N95 Respirators should be preserved for high risk aerosol generating procedures.

Study on [15], stated that face mask when exposed to ozone gas for approximately 1 min by DBD plasma generator can rapidly disinfect mask contaminated with SARS COV-2 along with its SEM and PPE test.

A research study on [2], revealed the importance of mask in prevention of disease specially emphasizing on surgical mask along with various tests to ensure its safety.

A study on [16], presented efficacy study on surgical mask in reducing respiratory virus shedding in respiratory droplets and aerosol of symptomatic individuals with Corona virus, Influenza and Rhino virus infection statically and graphically.

A review on [17], meticulously explained the clinical considerations, rationale, use and disposal of N95 Respirators, surgical masks and cloth mask in community settings along with evidence summary to prevent COVID-19.

A scoping Review on [6], suggested that vaporized hydrogen peroxide and ultraviolet irradiations seems the current decontamination strategies for N95 mask.

A review on [18], stated several types of mask, its filtering efficiency and particle size along with current guidelines by various countries on wearing mask.

A review on [19], presented the description of community mask, fabric samples tested against air permeability, absorption, resistance to water and particle size filtration. A comment on [20], use of face masks in the COVID-19 pandemic, compared face-mask use recommendations by various authorities in community settings.

In a letter [21], emphasized on how mask works, mechanism, basic concepts of size, mask filters and uniqueness of electro spun nanofiber mask right from assembling it at home.

In an editorial article [22], diagrammatically illustrated relative protection factors among different patterns of combination of mask scenarios.

Table 1

Comparative study on mask use in public by various authors till date.

Author	Recommended mask	Comment
Chughtai AA, Seale H [9] Mueller AV, Fernandez LA [10]	Cloth mask Fabric Mask over Surgical mask	Recommendations with regard to use of cloth masks Information on commercially fabricated and sewn fabric mask by assessing them in terms of their particle filtration efficiency
De Silva AP, Niriella MA, de Silva HJ [11] Leffler CT, Ing EB [12]	Respirators Various Mask especially focused on its use	Respirators should be preserved for Primary healthcare Professional Statistically analysed the per capita mortality by Corona virus and graphically representation of mask effect
Chiang J, Hanna A, Lebowitz D [13] Howard J, Huang A [14]	Elastomeric Respirator Non-medical mask	Utilization of reusable Elastomeric Respirators Filtering capabilities and mask efficiency study and impact on community transmission by mask
Bartoszek JJ, Farooqi MA [4] Lee J, Bong C [15]	N95 mask N95 mask	N95 Respirators should be preserved for high risk aerosol generating procedures Exposing to ozone gas for approximately 1 min by DBD plasma generator can rapidly disinfect mask contaminated with SARS COV-2
Arora J, Roy VK [2] Leung NH, Chu DK [16] Qaseem A, Etzeandia-Ikobaltzeta I [17] Onofre R, Borges R [6]	Surgical mask Surgical mask N95, surgical and cloth mask N95 mask	Emphasized on surgical mask along with various tests to ensure its safety Efficacy study on surgical mask in reducing respiratory virus Clinical considerations, rationale, use and disposal of N95 surgical and cloth mask Vaporized hydrogen peroxide and ultraviolet irradiations seems the current decontamination strategies for N95 mask
Rab S, Javaid M, [18]	Various mask	Types of mask, its filtering efficiency and particle size along with current guidelines by various countries on wearing mask
Sousa-Pinto B, Fonte AP [19]	Various Fabric masks	Description of community mask, fabric samples tested against air permeability, absorption, resistance to water and particle size filtration
Feng S, Shen C [20]	disposable mask, reusable masks	Stressed on measures to prolong life of disposable mask and reusable masks should be encouraged
Tebyetekerwa M, Xu Z [21]	Electro spun nanofibers-based face masks	Mechanism, basic concepts of size, mask filters and uniqueness of electro spun nanofiber mask right from assembling it at home
Liu R, Fleisher LA [22]	Surgical masks and respirators	Illustrated relative protection factors among different patterns of combination of mask scenarios

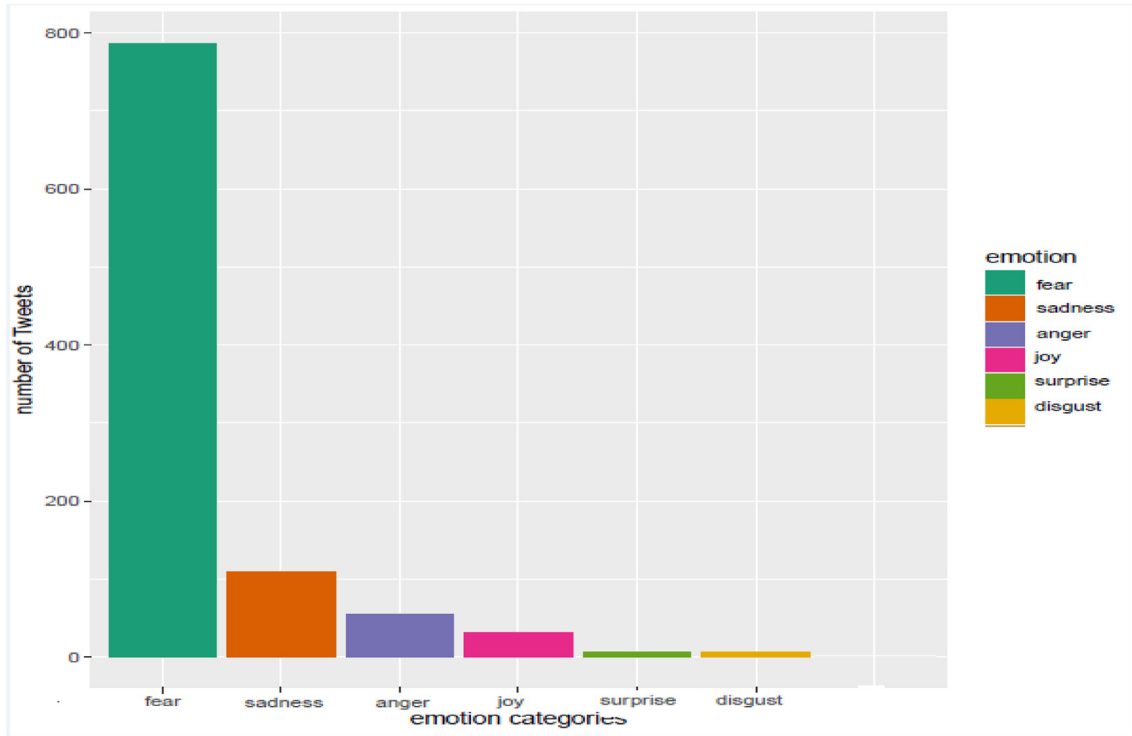


Fig. 1. Emotion categories.

Research [23–25] has been conducted and developed a framework to examine the usage of mask, population impact, transmission areas etc and the recommend that the everyone should wear a public cloth mask to control the transmission of disease.

Table 1 shows comparative study on mask use in public by various authors till date

3.1. Case study 1: Opinion mining using real time data for analysing views on mask

Most Popular Social Media Twitter is used as a source of data. Small messages called tweets related to masks has been extracted with R Analytical Tool and Twitter developer site. Approximately 1 K tweets are taken out and used to analyse people emotions, feelings about the usage of masks. Following steps carried out.

1. Extract and store mask related tweets in csv (comma separated value) format.
2. Data pre-processing like clean the data by removing unwanted space, numbers, punctuations, links etc. in R analytical tool.
3. Naïve Bayes classifier is used to separate out different emotions of tweets

Implementation in R:

```
Class_emo = classify_emotion(var1, algorithm="bayes",
                             prior = 1.0, verbose = TRUE)
# get emotion best fit
emotion = class_emo[7]
# substitute NA's by "unknown"
emotion[is.na(emotion)] = "unknown"
```

4. With bayes algorithm, text is categorised as negative, positive and neutral. Source code is as follows

```
polarity = class_pol[,4]
# data frame with results
sent_df = data.frame(text = var1, emotion = emotion,
                     polarity = polarity, stringsAsFactors = FALSE)
```

Emotions are classified as fear, sadness, anger, joy, surprise etc. Fig. 1 shows the results based on classification of emotions which people are facing and talking about. Similarly, some people have positive, neutral or negative thoughts, shown in Fig. 2.

It is seen that people are wearing a mask by considering overall situation of current pandemic and facing different experiences. Near about 80% people feeling fear about usage of mask whereas

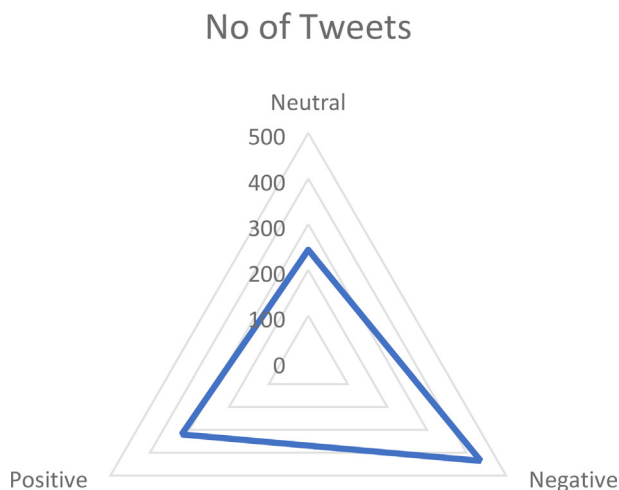


Fig. 2. Polarity categories.

Table 2

Extracted topics.

Topic	Weight
face dont cut	8.272222
face mask world	7.905943
Wear face mask	4.905943
asthma dont	4.75
double mask	4.383721
good seal	4.083333
ident class	4
pas ona	4
dozen scene	4
music grant	4
covid	1.428571
point	1.111111
cleanness	1.095238
rememb	1
guess	1
direct	1

**Fig. 3.** Masks for professionals.

10 % people feeling sad while wearing mask. It has been observed that proportionally very less number of people are expressing anger, surprise, disgust.

3.2. Case study 2: Topic extraction

To observe the topics related to usage of mask, comments has been used and RAKE (Rapid Automatic Topic Extraction) [26] topic extraction algorithm has been implemented in python technology.

By implementation of algorithm it is observed that topics like Wear face mask, Asthma, Cleanness, double mask are trending topic which are shown in Table 2.

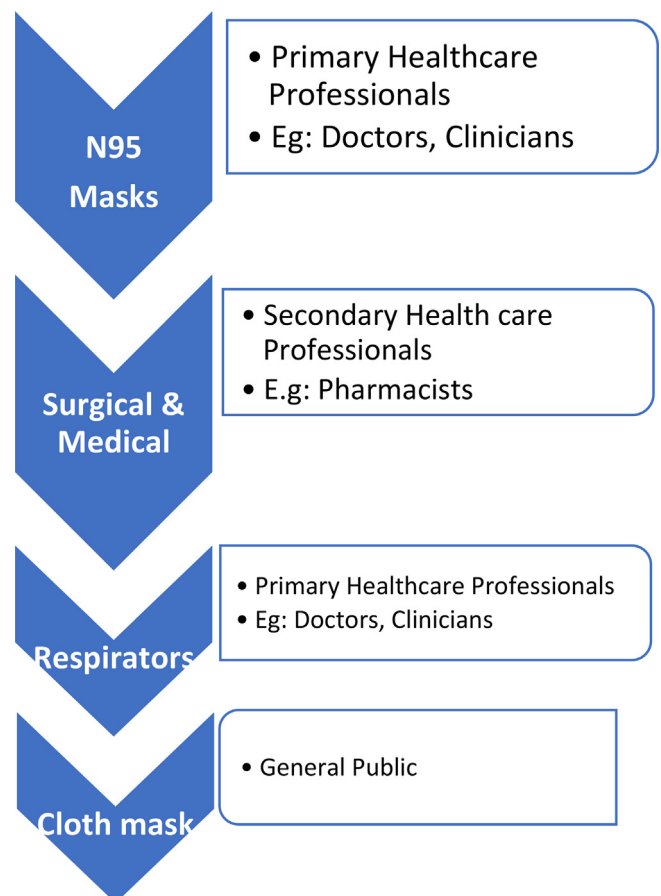
4. Outcomes, discussions and conclusions

1. From the real time data set it is seen that people are facing very much fear and sadness with use of face mask. Many people have negative thoughts as compare to positive and neutral thoughts.

Studies from all over the world concluded that wearing a proper face mask is the best preventive measure and same has been recommended as Covid appropriate behaviour by international health institutes.

2. Maximum number of people feels fear about usage of mask, like oxygen level may fluctuate due to mask, especially asthmatic people are very concerned about wearing mask and issues related to asthma. As per recent surge in the cases of black fungus, public has got more anxious about usage of mask. With increase of numbers of black fungus patients some rumours are spread that the said disease may be caused because of unwashed mask, wet mask or wrong type of mask. Some wrong information says that faulty mask can be the reason of issues related to asthma. Similarly, people are facing many doubts about which mask can be use? Some are confused about how to wear a mask? Some has issue like which type of mask can be used.
3. As reviewed literatures it is seen that there are different types of masks are available in the market. Use of mask is mandatory to secure from getting infection. As per profession people can use mask to get comfort in their work and must be use mask. Fig. 3 and Fig. 4 shows the recommendation of masks with appropriate profession.

It is concluded that wearing Face mask at public places which is mandated by Government and various health organizations is much helpful in ceasing the spread of disease effectively and implement various strategies and restrictions on use of face mask like N95 mask and Respirators should be reserved for frontline health care professionals involved in high risk procedures(aerosol

**Fig. 4.** Recommendation of mask with appropriate profession.

generating) along with PPE kits, while Surgical and medical masks shall be preserved for health care professional involved in low risk procedures (non-aerosol generating) and general public must wear cloth mask at public places.

CRediT authorship contribution statement

Priyanka P. Shinde: Data curation, Visualization. **Varsha P. Desai:** Conceptualization. **Smita V. Katkar:** Methodology, Writing – review & editing. **Kavita S. Oza:** Investigation, Writing – original draft. **R.K. Kamat:** Validation, Supervision, Writing – review & editing. **Chetan M. Thakar:** Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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